METHODOLOGICAL APPROACHES TO INTEGRATING ARTIFICIAL INTELLIGENCE TECHNOLOGIES INTO THE COURSE "INFORMATION TECHNOLOGIES IN PRIMARY EDUCATION"

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Abstract

The transformation of teacher education under the influence of generative artificial intelligence requires a methodological reconsideration of how digital tools are introduced into professional preparation. This paper develops a systematic approach to integrating intelligent digital systems into the course "Information Technologies in Primary Education". The study focuses on the relationship between technological functionality and pedagogical purpose, arguing that effective integration depends on instructional design, critical evaluation, professional judgement and ethical responsibility rather than on the number of digital services used. Recent international frameworks, particularly UNESCO's AI Competency Framework for Teachers (2024) and the OECD Digital Education Outlook 2026, provide the conceptual basis for the proposed approach. The paper develops a five-stage instructional cycle comprising pedagogical problem identification, purposeful functional selection, preliminary production, critical verification and pedagogical adaptation, and application with reflection. The model is complemented by principles of human agency, developmental appropriateness, data protection, academic integrity and transparency. Practical applications are described for lesson planning, differentiated instruction, formative assessment, educational content development, microteaching and reflective practice. The proposed framework may contribute to the systematic development of future primary school teachers' capacity to use intelligent digital systems as instruments of pedagogical design while preserving independent reasoning and professional responsibility.

Keywords: generative artificial intelligence, primary education, teacher education, digital pedagogy, instructional design, intelligent educational systems, professional judgement, critical evaluation, formative assessment, human agency, ethical use.

Introduction

The rapid development of generative artificial intelligence has become one of the most significant changes affecting contemporary education. Systems capable of producing text, images, explanations, questions, summaries and other forms of digital content are increasingly accessible to teachers and students. Their emergence creates opportunities for reducing routine preparation time and expanding the range of educational resources. This question is particularly important in the preparation of primary school teachers. The teacher working with younger pupils operates in a learning environment where developmental psychology, language acquisition, motivation, classroom interaction and differentiated instruction are closely connected. Consequently, a technically correct digital resource may still be pedagogically inappropriate. A generated explanation may be factually accurate but linguistically complex; an automatically produced task may not correspond to pupils' cognitive development; a seemingly attractive activity may not serve the stated learning outcome. For this reason, teacher education should develop the capacity to examine and transform digital outputs rather than simply consume them. The course "Information Technologies in Primary Education" has substantial potential for addressing this challenge because it is positioned at the intersection of information technology and primary-school pedagogy. Its content can move beyond conventional office applications, presentation tools and basic digital resources toward the purposeful use of contemporary intelligent systems. Such transformation, however, requires a coherent methodological framework that connects technological operations with learning objectives, curriculum requirements and professional tasks. The OECD Digital Education Outlook 2026 adds an important empirical and conceptual distinction. Its analysis indicates that general-purpose generative systems can improve the quality of completed tasks without necessarily improving learning when cognitive work is simply delegated to the system. Conversely, carefully designed use can support learning processes, critical thinking and other educational outcomes. Thus, the methodological issue is not whether intelligent systems should be present in education, but how their use is structured. The purpose of this study is to substantiate methodological approaches for integrating intelligent digital systems into the course "Information Technologies in Primary Education" and to propose a practical instructional model for preparing future primary school teachers for responsible, critical and productive use.

The integration of emerging digital systems into teacher education should be considered within a broader transformation of pedagogical knowledge. Technological knowledge alone does not guarantee effective teaching. A future teacher must understand the relationship between technology, subject content and pedagogy. In this respect, the logic of technological pedagogical content knowledge remains relevant: a tool becomes educationally meaningful only when it is connected with what is being taught, how pupils learn and why a particular instructional strategy is selected. The competence-based perspective provides another important foundation. From this standpoint, the learning outcome is not the ability to operate a particular service but the ability to perform a professional task with appropriate technological support. For example, the student should be able to design a differentiated exercise, evaluate a generated explanation, formulate formative feedback or develop a lesson fragment. The specific digital service may change over time, whereas the underlying professional capability remains relevant. The human-centred perspective is equally significant. Intelligent systems should extend the teacher's capacity for analysis and creation without transferring pedagogical responsibility to an automated mechanism. The teacher remains responsible for selecting content, determining learning objectives, considering pupil characteristics and evaluating the consequences of instructional decisions. This principle prevents technology-centred teaching from becoming the dominant model.

The constructivist perspective also provides a useful basis. Learning is strengthened when students actively formulate problems, compare alternatives, explain decisions and revise their work. Therefore, intelligent systems can be used as objects of critique and sources of alternatives rather than as providers of final answers. A student who receives three automatically generated lesson ideas and evaluates them against curriculum requirements may gain more pedagogical understanding than a student who simply copies one of the ideas. The reflective approach complements these perspectives.

Traditional digital literacy courses often concentrate on functional knowledge: creating documents, preparing presentations, searching for information and using communication platforms. These abilities remain necessary, but they are no longer sufficient for professional preparation in an environment where automated systems can perform a growing number of routine operations. The new situation requires a transition from functional literacy toward judgement-oriented literacy. The central competence becomes the ability to decide whether a digital solution is appropriate, evaluate its output and adapt it to a specific educational context. This shift is especially relevant for primary education because the consequences of inappropriate content may be more significant when pupils are still developing basic conceptual, linguistic and digital skills. Another reason for methodological change is the problem of cognitive outsourcing. If students repeatedly use automated systems to formulate explanations, solve problems and write reflective responses, they may complete assignments efficiently while engaging less deeply with the underlying knowledge. The teacher education programme should therefore design tasks in which technology supports cognitive activity rather than replacing it. A productive strategy is to require visible human contribution. Students can be asked to submit an initial pedagogical plan, the generated alternatives, their critique of those alternatives and the final revised version. Such a structure makes the reasoning process observable and allows assessment to focus on professional judgement. The methodological orientation should also account for reliability.

Generated content may contain factual errors, fabricated references, inappropriate generalisations or biased formulations. Students therefore need systematic verification habits. These may include comparison with official curricula, textbooks, peer-reviewed literature and trusted institutional sources. Verification should become a normal stage of digital work rather than an optional precaution.

The first principle is pedagogical purposefulness. Every activity involving an intelligent system must be linked to a clearly formulated learning objective. If the same objective can be achieved more effectively through independent work, discussion or conventional digital tools, the use of automated generation is not necessary. The second principle is developmental appropriateness. Resources designed for primary pupils must correspond to their age, language development, prior knowledge and attention capacity. Students preparing such materials should therefore learn to revise complexity, vocabulary, examples, visual structure and instructions. The third principle is critical verification. No generated educational material should be accepted without examination. Students should identify unsupported claims, ambiguities, factual errors, repetition and inappropriate assumptions.

The fourth principle is human agency. Automated systems can propose alternatives, but the final pedagogical decision belongs to the teacher. This principle should be visible in course assessment: students should explain and defend their choices. The fifth principle is ethical and safe use. Teacher candidates should understand privacy, copyright, transparency, academic integrity and responsible handling of pupil information. Personal data should not be entered into public systems without an appropriate legal and institutional basis. The sixth principle is gradual complexity. Initial activities should focus on understanding basic functions and limitations. Later activities should require comparison, adaptation, integration into lesson design and independent creation. This progression corresponds with international competency frameworks that distinguish acquisition, deeper application and creative development. The seventh principle is reflection. Students should document what they learned about both the technology and the pedagogical problem. Reflection allows them to recognise that successful use depends on the quality of the instructional task and the teacher's decisions.

Lesson planning represents one of the most accessible areas for integration. Future teachers may use intelligent systems to generate alternative lesson structures, questions or activities, but the educational objective should be established independently. Students then compare the proposals with curriculum requirements and select or redesign elements. For example, a lesson on reading comprehension can begin with a teacher-defined objective: pupils should identify the main idea and support their interpretation with evidence from a text. An automated system may generate several question sets. The student analyses the cognitive level of each question, removes superficial items and adds questions requiring explanation. The final resource therefore represents a human-designed product supported by automated suggestions. The same method can be applied to mathematics. Students may request several word problems at different levels of difficulty and then check whether the numerical relationships are correct, whether the language is appropriate for primary pupils and whether the problems correspond to the intended mathematical concept. This activity develops both content knowledge and evaluation skills. Lesson planning should therefore be assessed through the quality of alignment among objective, activity, material and assessment. The use of a digital generator should not itself increase the grade. The educational rationale and quality of adaptation should determine the result.

Primary classrooms contain pupils with different levels of prior knowledge, learning pace and interests. Intelligent systems can support the preparation of several task variants, but differentiation must be based on pedagogical analysis rather than automatic categorisation. Students can be asked to design a basic, intermediate and advanced version of the same task. The system may generate preliminary variants, after which the teacher candidate checks whether the differences represent meaningful changes in cognitive demand rather than merely shorter or longer texts. This distinction is important because effective differentiation concerns the nature of learning activity, not only its volume. Another useful activity is adaptation of explanations. A concept can be explained in formal language, simplified language and through an example. Students compare these versions and determine which elements are appropriate for a particular age group. They then create a final explanation and justify their choice. This process can strengthen future teachers' ability to design inclusive learning materials. However, the course should avoid presenting automated personalisation as a substitute for teacher observation. Individual learning needs cannot always be inferred from digital data, and pedagogical decisions require contextual knowledge.

The preparation of worksheets, reading materials, examples, quizzes and multimedia scripts can consume substantial teacher time. Intelligent generation can reduce the routine component of this work, but educational quality depends on subsequent editing. A methodological task may require students to produce a preliminary worksheet, identify at least five weaknesses and redesign it. Weaknesses can include inaccurate terminology, repetitive questions, unclear instructions, inappropriate difficulty or insufficient connection to the lesson objective. The exercise thereby turns content generation into an analytical task. Students should also learn to distinguish between original contribution and automatically produced material. Where institutional rules require disclosure of automated assistance, this should be reflected in their academic work. Such transparency supports academic integrity and develops responsible professional practice.

Assessment is another area in which automated assistance can support teacher preparation. Students may generate possible formative questions, rubrics or feedback statements and then evaluate their quality. A particularly useful activity is feedback revision. The system produces a generic comment such as an indication that an answer is incomplete. The student must transform it into constructive feedback that identifies the learning gap and gives the pupil a clear next step. This develops assessment literacy and communication skills. Rubric design can also be supported through comparison. Students request alternative criteria for a project and then determine which criteria are observable, measurable and aligned with the learning objective. They subsequently produce the final rubric independently. The methodological emphasis should remain on assessment validity. Automated feedback is useful only when it corresponds to the actual work of the learner. Consequently, teacher candidates must learn to inspect the evidence before accepting a suggested judgement.

Microteaching provides a controlled environment for testing technology-supported instructional decisions. Students prepare a short lesson fragment, use an intelligent system during preparation, conduct the activity with peers and analyse the result. The process can include four roles: teacher, learner, observer and analyst. The observer records clarity of instructions, interaction, time management and appropriateness of materials. The analyst examines how the digital tool influenced preparation and whether the final lesson depended excessively on automated suggestions. Such an environment makes professional learning visible. Students can compare the first draft with the final lesson and identify which improvements were technological and which resulted from pedagogical reasoning. The latter distinction is important for understanding the role of the teacher.

A modern teacher preparation programme should develop the ability to understand both possibilities and limitations of intelligent systems. This includes knowledge of how generated content may be produced, why errors occur, how prompts influence outputs and why confident language does not guarantee factual reliability. Critical literacy also involves understanding bias. A generated example may unintentionally reproduce stereotypes, favour particular cultural assumptions or exclude certain groups. Teacher candidates should therefore evaluate language, representation and inclusiveness before classroom use. Another component is source verification. Students should distinguish between generated statements and evidence supported by authoritative literature. References suggested by automated systems must be checked independently. This is particularly important in academic writing, where fabricated or inaccurate citations can undermine the credibility of the work. The course should consequently include dedicated exercises in verification, comparison and correction. These activities transform students from passive users into critical evaluators.

Responsible integration requires attention to privacy and data protection. Information about pupils, including names, individual learning difficulties or identifiable records, should not be entered into external services without a legitimate basis and appropriate safeguards. Copyright is another important issue. Generated text or images may resemble existing works, and the legal status of outputs can vary by jurisdiction and service conditions. Teacher candidates should therefore learn to use original classroom materials responsibly and respect institutional policies. Academic integrity requires particular attention in higher education. If students use automated assistance to draft assignments, they should understand the difference between assistance and substitution. A completed academic task should demonstrate the student's own understanding, analysis and argumentation. A five-level rubric can be used for practical assignments: beginning, developing, competent, advanced and creative. At the beginning level, students rely heavily on generated material and provide limited justification. At the competent level, they can select, verify and adapt outputs. At the advanced level, they integrate alternatives into coherent instructional design. At the creative level, they independently formulate new educational solutions and use digital systems as one component of a broader pedagogical strategy.

The course can be reorganised so that each theoretical topic is followed by an applied activity. A 90-minute practical session may contain a short conceptual introduction, problem formulation, guided digital activity, independent adaptation, peer evaluation and reflection. This structure reduces passive demonstration and increases active professional practice. For example, a session on digital educational content can begin with analysis of a poor-quality worksheet. Students identify its weaknesses, produce an alternative with automated assistance, verify the result and compare it with an independently designed version. The final discussion focuses on which process produced better learning value and why. Project work can extend this approach over several weeks. Each student or group develops a small digital learning product for a primary-school topic. The project portfolio includes the pedagogical problem, initial design, technological assistance, verification notes, revised product, peer feedback and final reflection. Such documentation makes the learning process assessable. Systematic integration can influence several aspects of professional preparation. First, it can increase the efficiency of routine resource development. Second, it can expose students to a broader range of instructional alternatives. Third, structured verification can strengthen critical thinking. Fourth, project-based activities can connect digital knowledge with actual pedagogical tasks.

The most important expected effect, however, is the development of professional agency. Future teachers should become capable of deciding when a digital system adds educational value and when it does not. This ability is more durable than knowledge of any particular platform because digital services change rapidly. Another expected outcome is improved reflective practice. When students record the limitations and revisions associated with digital assistance, they become more conscious of their own pedagogical decisions. Reflection can also reveal situations in which automated support saves time but does not improve learning quality. The approach may therefore contribute to a balanced professional profile in which technological fluency is combined with subject knowledge, pedagogical judgement, ethical awareness and critical thinking.

The central methodological finding is that the educational value of intelligent digital systems depends strongly on task design. If the assignment requires only a final answer, automation may reduce cognitive engagement. If the assignment requires comparison, justification, verification and revision, the same technology can stimulate higher-order activity. This finding supports the distinction between performance enhancement and learning enhancement. A student may produce a polished lesson plan more quickly with automated assistance, but this does not necessarily mean that the student has learned how to design lessons. To ensure learning, the educational process must make the student's reasoning visible. For teacher education, this means that assessment should move away from evaluating only the final product. Drafts, revisions, explanations and reflections should also be considered. Such an assessment structure discourages uncritical copying and rewards genuine professional development. The framework also suggests that institutional policy should accompany methodological reform. Teachers and students need clear expectations concerning privacy, disclosure, academic integrity and acceptable use. Without such guidance, classroom practice may develop inconsistently.

Conclusion

The integration of intelligent digital systems into "Information Technologies in Primary Education" represents a methodological transformation rather than a simple expansion of the list of digital tools taught to future teachers. The main educational task is to develop the capacity to connect technological possibilities with learning objectives, pupil characteristics and professional responsibility. The proposed framework places pedagogical reasoning at the centre of technology-supported activity. Its five stages—problem identification, purposeful selection, preliminary production, critical verification and adaptation, followed by application and reflection—provide a flexible structure for lectures, practical classes, projects and microteaching. The approach is particularly relevant to primary teacher education because younger learners require carefully selected, developmentally appropriate and inclusive materials. Automated systems can assist with the production of alternatives, but they cannot replace the contextual knowledge and ethical responsibility of the teacher. Accordingly, the effectiveness of integration should be judged not by the volume of generated content or the number of platforms mastered, but by the extent to which future teachers can evaluate, adapt and responsibly apply digital resources. Such preparation can support the formation of teachers who are technologically capable, critically minded and professionally autonomous.

References

1. UNESCO. (2024). AI Competency Framework for Teachers. Paris: UNESCO. DOI: 10.54675/ZJTE2084.
2. OECD/European Commission. (2026). Empowering Learners for the Age of AI: An AI Literacy Framework for Primary and Secondary Education. Paris: OECD Publishing. DOI: 10.1787/65cd27d4-en.
3. OECD. (2023). OECD Digital Education Outlook 2023: Towards an Effective Digital Education Ecosystem. Paris: OECD Publishing. DOI: 10.1787/c74f03de-en.
4. Holmes, W., Bialik, M., & Fadel, C. (2019). Artificial Intelligence in Education: Promises and Implications for Teaching and Learning. Boston: Center for Curriculum Redesign.
5. Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence Unleashed: An Argument for AI in Education. London: Pearson.
6. To'xtamurodov, A. (2026). Цифровизация Деятельности Регистраторского Офиса И Механизмы Эргономической Интеграции В Высших Учебных Заведениях. Scientific and innovative research in the social and humanitarian sphere, 3(4), 572-575.